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China's GDP: Examining Provincial Disparity

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Contents

Abstract

Widening provincial disparities have accompanied the rapid economic growth in China. This paper analyses the evolution of China's provincial GDP per capita disparity between 1952 and 1998. First, a brief literature review is presented. Then, an examination of some basic indicators of disparity is carried out, and a test for unconditional convergence is performed to explore the dispersion features. Subsequently, a more comprehensive regression analysis, allowing insights into the evidence of conditional convergence and highlighting the main determinants of growth in two main periods of the recent history of China (i.e., pre-reform and post-reform) is presented. Finally a discussion and conclusion are provided.

Acknowledgments

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China’s GDP: Examining Provincial Disparity

Can Wang

1. Introduction

The latter half of the 20th century saw the prominent emergence of China in the world economy, attracting worldwide attention. China has become the world’s seventh largest economy (the second largest economy when measured in terms of purchasing power parity) and second largest recipient of foreign direct investment, and has followed a rapid growth path with an annual average rate of over 10 percent since 1978 when it adopted an “open door” policy and market-oriented economic reforms.

The real annual GDP per capita growth rate, according to official statistics, increased from an average of 4.3% in the pre-reform period (1953-1978) to a record of 8.3% during the reform period (1979-1998). Although there have been some suspicions about the reliability of official statistics, rapid economic growth in China, especially during the reform period, is broadly accepted as a fact.

On the other hand, China is a land of considerable regional variation in growth experience. Alongside the fast economic growth, one of the most noteworthy aspects of China’s GDP performance has been its widening regional disparity. The coastal area is booming at an average 10.3% annual growth rate of real GDP per capita in the reform era, while the inland provinces also grow, but at a slower pace of 8.2% annually. As a consequence, the gap between coastal and inland provinces is growing fast. In 1998, the per capita GDP of Shanghai, the richest provincial unit, was 12 times that of Guizhou, the poorest province.

Given the significant impacts of regional disparity on economic, social, and political developments, clarifying the trends of China’s provincial GDP per capita disparity during both the pre-reform and post-reform eras, and understanding the mechanisms and determinants behind the differences in provincial development have important implications for current policies such as the Western China Development Strategy currently under implementation and also for the future growth of China.

Few studies have assessed the evolution of disparity in recent Chinese history over a long time period. Most of them have focused on relatively short periods, especially the post-reform years. This paper presents and analyses the evolution of China’s provincial disparity for the period 1952 to 1998. The analysis here proceeds as follows. Section 2 presents a brief literature review. In section 3 some basic indicators of disparity are examined and a test for unconditional convergence is performed. A more comprehensive regression analysis, allowing insights into the evidence of conditional convergence and highlighting the main determinants of growth in two main periods of the recent history of China (i.e., pre-reform and post-reform) is performed in section 4. Finally a discussion and conclusion are provided in section 5.

The analysis of the basic indicators shows a widening disparity in the 1990s. It also illustrates that large disparities exist both between and within coastal and inland regions. Relative disparity appears to grow faster within the coastal region. In contrast, the provinces within the inland region have similar paces of growth, although with large differences in terms of their absolute GDP per capita levels.

When testing for unconditional convergence, it appears that there is no evidence either of unconditional convergence or of divergence during the sub-period of pre-reform (1952-78) or the entire period under examination from 1952 to 1998. During the post-reform era, there are some evidences of unconditional convergence for the first sub period (1979-89). However, the trend of unconditional convergence ceased when the second sub-period (1990-98) of post-reform began.

The econometric regression based on the conditional convergence growth framework gives evidence for conditional convergence. The coefficient of the initial GDP level has a negative sign and strong statistical support in most of the various equation specifications considered. In addition, the variables representing the effects of openness policy, human capital investment and agriculture share of GDP are identified as key factors influencing China's provincial GDP per capita disparity.

2. Explaining the Disparities: Brief Literature Review

Studying regional disparities in China has been a lively field in the recent years, with different studies giving various explanations for the causes of the disparities. For example, Duncan and Tian (1999) explain the provincial output disparities mainly by the different characteristics of industrialization in the pre-reform and the post-reform periods. Zheng *et al.* (2000) point out the main causes of China's regional per capita income inequality as differences in three aspects: location, industrial structure and policy impact. Fujita and Hu's (2001) conclusions include three factors, i.e., biased regional policies, globalization and economic liberalization, and foreign direct investment.

Song *et al.* (2000) achieve the result that regional disparities are caused by historical factors, geographical factors, and regional development policies of the government. Lee (2000) shows that the dominant sources of overall regional inequality in output have shifted: from the intra-provincial to inter-provincial inequality, from the rural-urban to intra-rural inequality and also from disparity within coastal regions to disparities between the coast and the interior. Batisse (2001) provides empirical evidence on the relation between industrial structure and China's provincial growth performance.

Naughton (2002) provides an interesting guide for understanding the convergence patterns of Chinese provinces, relating the changes to the evolution, and subsequent erosion, of the system of interregional redistribution across provinces. The redistribution system modified the patterns of industrial development during the pre-reform period. Provinces with low income levels and little industrial development and output received large amounts of government support for industrial investment. Already in the 1970s and before the reform, however, the redistributive effort was reduced. During the 1980s, after the reform was introduced, the government reduced the size of redistribution efforts even further and ceased to redistribute industrial investment toward poorer provinces. Eventually, the redistribution system was no longer an important driving force of regional development, and regional trends and differences became more and more influenced by market forces. However, past redistribution still influenced the further development across regions.

Another seven published econometric studies, which come close to the spirit of this study's interest in China's regional GDP disparities, have been summarized briefly in Table 1. Most studies among them have chosen the average annual growth rate of provincial GDP per capita as dependent variable and focused on the post-reform era, with only one exception, that of Kanbur and Zhang (2001) who investigated both the pre-reform and the post-reform periods but using an inequality indicator as the independent variable.

Some of the findings from the different studies are not consistent. For example, Zhang (2001) concludes that the coastal dummy variable is significant in 1985-94, but not in 1978-84, while Tian (1998) finds that the coastal dummy turns out to be insignificant after introducing a variable to reflect the market functioning. On the other side, there are some common findings. For instance, the variables that capture openness policies show positive and significant impact on regional disparity in all studies that include them, even though the indicators of openness vary in different studies.

Although neither generally agreed upon, nor complete explanations have been achieved, the key factors that attracted relatively common attention in the broad literature appear to be certain. Among them are institutional quality (e.g., domestic decentralization, international openness), geographic difference (e.g., regional dummy, resource abundance), capital accumulation (e.g., both physical and human capital investment), demographic variables (e.g., total population growth, working-age population growth, migration), and structural variables (e.g., agriculture share of GDP, industrialization, urbanization).

Table 1: Summary of several quantitative studies on China's regional income disparities.

Studies	Time span	Independent Variables	Major findings
Zhang (2001)	1978-84 1985-94	• Initial GDP per capita; • Domestic reform index; • Openness index (exports to GDP); • Regional dummies (coastal, west)	• The domestic economic reform does not play a direct role in the growth disparity • Openness index is significant in both sub-periods • Coastal dummy is significant in 1985-94, but not in 1978-84
Kanbur and Zhang (2001)	1952-78 1979-99	• The relative balance between heavy industry and agriculture; • The degree of decentralization' • The degree of openness to outside.	• Heavy industry prioritizing development policy plays a key role in forming the enormous rural-urban gap in the pre-reform period • Openness has contributed to the rapid increase in inland-coastal disparity in the reform period
Démurger *et al.* (2001)	1979-98 1979-84 1985-91 1992-98	• Initial GDP per capita • Coast dummy • Transportation cost and geography • Preferential policy • Initial agriculture; Initial state-owned-enterprises (SOE) size • Education level	• Conditional convergence is not statistically supported • The geography index coefficient increases in magnitude and statistical significance over time • The preferential policy coefficient y is generally stable and significant across time • All the specifications fit the data best during 1992-98, and the authors attribute it to the slow-acting nature of geographical forces.
Démurger (2001)	1985-98	• Production factors variables • Reform implementation and economic structure variables • Geographical constraints and infrastructure endowment	• Investment; Secondary education level; Share of agriculture; Share of collective sector; Foreign direct investment; Urbanization; Transport; Population density; Telephone; Distance to town; Village accessible by telephone are introduced to the models, and present statistically significant impacts on regional differences.
Tian (1998)	1978-93	• Initial GDP per capita • Coastal dummy • Domestic & international market index	• After introducing market functioning variable, the coastal dummy turns out to be insignificant.
Li *et al.* (1998)	1978-1995	• Real GDP • Labor force • Fixed investment ratio • Secondary school enrollment ratio • Ratio of FDI to GDP	• GDP per capita is shown to be higher in regional economies with lower population growth, greater openness to foreign countries and more investment in physical and human capital. • Regional economies are shown to converge both conditionally and unconditionally over the reform period
Chua and Bauer (1996)	1978-94	• Urbanization control variables • Educational attainment variables • Investment rates • Foreign investment variables	• Primary schooling variable is significant • The investment rate variables in interior regions had little effect, but they were significant in coastal regions (by introducing a variable of investment×coastal dummy) • Foreign enterprises import is positive, while its exports is negative

3. Time-series Properties of Provincial GDP per capita Disparity: 1952-1998

The analysis here has been concentrated on Mainland China. Hong-Kong and Macao have been excluded since those provinces exhibit special characteristics and their historical economic-growth paths differ significantly from those of the other provinces. Mainland China is currently divided into 31 provinces.[1] Figure 1 shows a map of these provinces and the division of the country into coastal and interior parts, together with the province names. The provinces indicated with shaded areas on the map belong to the coastal region. Provincial units with sea harbors are classified as part of the coast with the exception of Beijing located next to the port city of Tianjin. All other provincial units are classified as the interior.[2]

Chinese economic development history can be broadly divided into pre-reform (1949-1978) era and post-reform (1979-present) era. The pre-reform phase can be further subdivided into several sub-periods: Revolution and Land Reform (1949-56), The Great Leap Forward and the Great Famine (1957-61), Post-Famine Recovery (1962-65), and Cultural Revolution (1966-78).[3] The post-reform phase can also be divided into sub-periods as follows: Agricultural and Rural Reform (1979-84), Broadening of Reform (1985-91), and Deepening of Reform (1992-present). This division reflects important political and social events that have changed China's course and will be referred to when explaining the results of this analysis.

This section attempts to derive some estimates of disparities among China's 31 provinces by applying the data on GDP per capita recently released by the Chinese State Statistical Bureau (SSB, 1999). The data are available for the period 1952-1998. This means that the Chinese official GDP growth rates are accepted in this study and no attempt is made to conduct more sophisticated quality control analyses of the data. The reader, however, should bear in mind that the reliability of official Chinese statistics has been questioned to some extent in the available literature and, therefore, such caveat extends to the results derived here.

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[1] Chongqing, a former big city in Sichuan province, gained the same status as other three province-level metropolitan cities, i.e. Beijing, Tianjin and Shanghai, which increases the number of China's provinces to 31.

[2] Therefore, the coastal region includes 12 provinces: Beijing, Tianjin, Hebei, Liaoning, Shandong, Jiangsu, Shanghai, Zhejang, Fujian, Guangdong, Guangxi and Hainan; and the inland region includes 19 provinces: Anhui, Chongqing, Gansu, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia (Neimengg), Jiangxi, Jilin, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Tibet, Xinjiang, Yunnan

[3] The period known as the Cultural Revolution actually spans between 1966 and 1976. However, for simplicity and to avoid further subdivisions, we have given such label to the period 1976-1978 but the reader should be aware that this does not correspond to historical rigor.

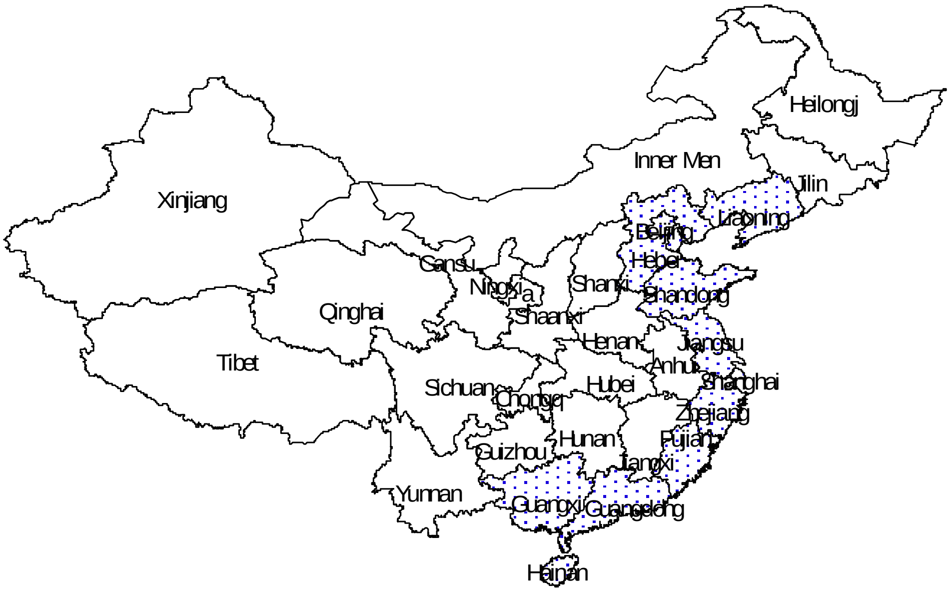

Figure 1: Province-level administrative division in mainland China. Shaded areas correspond to coastal provinces.

All GDP figures are converted and expressed in Chinese currency of RMB in 1998 constant prices. Region-specific price indexes are used to obtain GDP per capita in constant prices. The provincial specific deflators applied to the GDP per capita figures are also issued by SSB (1999).

This section aims to compare the findings from both absolute and relative measurements with different indicators. Absolute measurements demonstrate the level of difference among provinces; relative measurements show changes in provincial disparity that depend on the respective pace of growth in each province during the period under examination.

3.1 Basic indicators for the changing trends of provincial GDP differences

This sub-section presents the definitions of the basic indicators applied in this study. Standard deviation (SD) is chosen to describe absolute dispersion. As for measures of relative dispersion, the coefficient of variation (CV), the Gini coefficient (GC) and the ratio of high/low GDP per capita (RHL) are used.

When studying regional income differences, one of the issues not in general agreed upon by all researchers is whether or not to weigh the regional statistics by their population.[4] In this study, as the major focus is China's provincial GDP dispersion performance rather than the issue of general inequality, we do not introduce the

[4] For example, Tsui (1991) argues that population weights provide a more accurate measure of income inequality among individual members. However, Lyons (1991) shows that the use of population weights does not provide a clear picture of changes in the degree of regional inequality.

provincial population weighted index, with one exception, namely the use of GDP per capita in our estimations.

Standard deviation: The absolute dispersion is defined as the absolute value of a certain variable to the reference value. Generally, it can be expressed either by the extreme value or by the standard deviation. In this study, we will use the latter measurement, which is calculated by Equation 1:

$$SD(t) = \sqrt{\sum_{i=1}^{n} [Y_i(t) - \overline{Y}(t)]^2 / n} \qquad (1)$$

Where $Y_i(k)$ stands for the provincial GDP per capita, i for the province, n for the number of province to be measured, $\overline{Y} = \sum_{i=1}^{n} Y_i(t)/n$ represents national per capita GDP.

Coefficient of variation: The coefficient of variation is a relative measure of dispersion used when comparing the variability of two data sets. Dividing standard deviation by the arithmetic mean, we obtain the coefficient of variation, which is defined as:

$$CV(t) = \sqrt{\sum_{i=1}^{n} [Y_i(t) - \overline{Y}(t)]^2 / n} \Big/ \overline{Y} \qquad (2)$$

Gini coefficient: The Gini coefficient is another relative measure, which is an aggregate numerical indicator of inequality ranging from zero (absolute equality) to one (absolute inequality). The greater the value of the coefficient, the larger the inequality of the provincial GDP per capita distribution is. Here the following process is used to obtain the Gini coefficient:

Let $X_j(t)$ ($j = 1,2,\ldots,n$) be the per capita GDP of region j in year t, and $X_j(t)$ be arranged in an ascending order and renamed as $Y_i(t)$ ($i = 1,2,\ldots,n$). We have

$$Y_1 \leq Y_2 \leq \ldots \leq Y_n.$$

With

$$Z_i(t) = Y_i(t) \Big/ \sum_{i=1}^{n} Y_i(t), \quad i = 1, 2, ..., n$$

$$C_i = (n + 1) - i, \quad i = 1, 2, ..., n$$

We obtain the Gini coefficient as follows:

$$G_n(t) = a \sum_{i=1}^{n} C_i \times Z_i(t) - b \qquad (3)$$

Where $a = 2/n$; $b = (n + 1)/n$; n is the number of regions in the sample.

The Lorenz curve can be used to visualize the Gini coefficient. The Lorenz curve is a representation of the degree of inequality of a frequency distribution in which the cumulative percentages of a population are shown as a function of the cumulative percentage of the variable under study. A straight line rising at an angle of 45° from the origin indicates the hypothetical situation of perfect equality.

Ratio of high/low GDP per capita: The ratio of high/low GDP per capita (hereafter denoted as RHL) is defined as the ratio of the top per capita GDP to the lowest per capita GDP among the provinces. In order to avoid some special causes of disparity, such as a too small area and/or sparse population in a certain province, the RHL in this study is expressed by using the ratio of the arithmetic mean value of per capita GDP of the top five provinces to that of the bottom five provinces.

It is common in the literature to stress that one of the key dimensions of inequality in China is between inland and coastal regions (e.g., Kanbur and Zhang, 1999, 2001; Tian, 1998). In order to capture such aspect of inequality, the ratio of average per capita GDP between the coastal and inland provinces, denoted by RCI, is also calculated and analyzed in this study.

3.2 Estimation of the indices and some major findings

Given the provincial data, comprehensive time series can be constructed for the above-described disparity indicators. Figure 2 and Figure 3 show the time evolution of the five basic disparity indicators considered in this analysis.[5]

As illustrated by the historical trend of the standard deviation of per capita GDP (see Figure 3), a steady rising trend of the absolute dispersion took place during the period under analysis (1952-1998). Absolute disparities demonstrate the level of difference among provinces but are not very appropriate for comparing different data sets in different periods, i.e., to illustrate the changes in disparities over time.

Attention should therefore be given to relative disparities. Figure 4 presents the coefficients of variation of per capita provincial GDP constructed from two samples. The first one consisted of 28 provinces that had complete income data for the whole period of 1952–98.[6] The coefficient of variation of the 28 provinces' GDP per capita (measured in 1998 price) increased from 0.42 to 0.78 over the pre-reform period 1952–78. Along the generally rising trend there is a salient point (CV of 0.74) in the year of 1960, which is the end year of the Great Leap Forward phase. From the starting year of the market-oriented economic reform, the coefficient of variation showed a decline and reached 0.63 in 1990, resuming its upward trend afterwards.

[5] The numerical values are listed in Table A1 in the appendix.
[6] Among the total 31 provinces, GDP data for Tibet are not available and those for Hainan are included in Guangdong province before 1978. Chongqing data are consolidated with those of Sichuan.

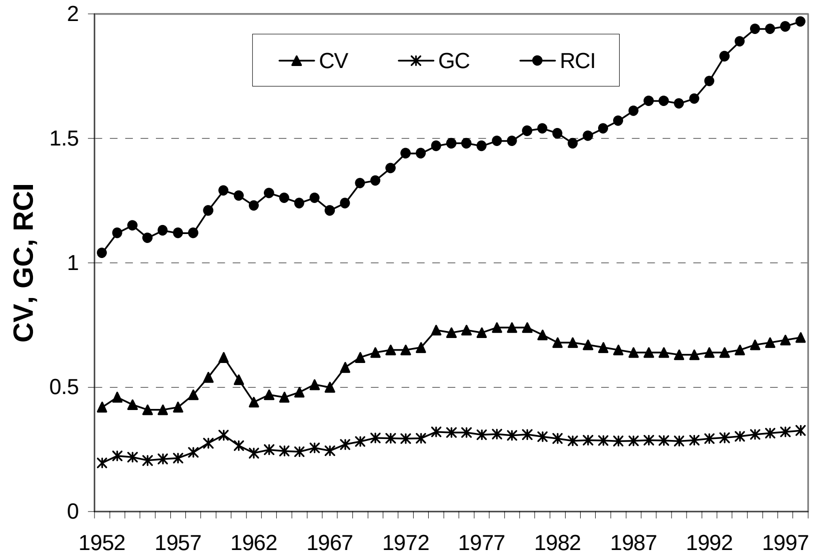

Figure 2: Time evolution of the Coefficient of variation (CV), Gini coefficient (GC) and the Ratio of average GDP/Capita between coastal and inland regions (RCI). Note: Hainan province and Tibet autonomous region are excluded due to incomplete data; Chongqing's data is consolidated with Sichuan province. Thus the real samples number is 28.

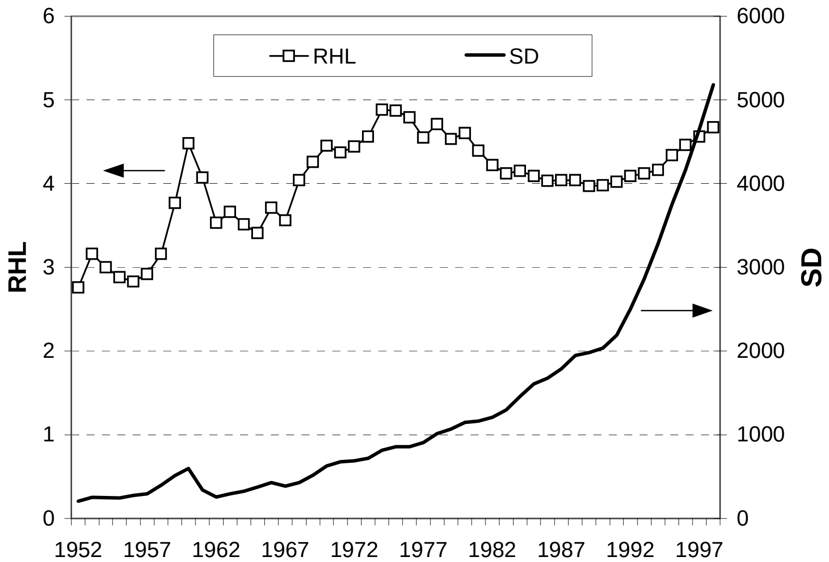

Figure 3: Time evolution of the Ratio of High/Low GDP per Capita (RHL) and the Standard Deviation (SD). Note: Hainan province and Tibet autonomous region are excluded due to incomplete data; Chongqing's data is consolidated with Sichuan province. Thus the real samples number is 28. The Y-coordinate of SD is on the right side of the graph. The Y-coordinate of RHL is on the left side of the graph.

Including the three metropolitan cities (i.e., Beijing, Shanghai, and Tianjin) in the coastal group to compare with other inland provinces is problematic as these three cities are mainly urban economies. They are much smaller and homogenous than other provinces in the sample, and they have been traditionally richer than other provinces, closer to coastal areas. In addition, they operate as administrative and power centers and seem to have been particularly favored during the pre-reform period (Démurger *et al.* 2001). For this reason, a second sample of GDP per capita excluding these metropolitan cities is constructed. The lower line in Figure 4 reflects the resulting CV. Comparing with the CV of the 28-provinces sample, the CV of the 25 (metropolis-excluded) provinces is much lower and relatively flat during the pre-reform period 1952-78, with only one obvious fluctuation between the end of 1950s and the beginning of 1960s. For the post-reform phase (1978-98), however, the CV of this sample shows a similar trajectory to that of the 28-provinces sample. That is, a clear downward trend in 1980s and an upward trend in 1990s are evident.

The differences between the coefficients of variation of these two samples reveal that the fact that the GDP per capita of the three metropolitan cities has traditionally been larger than in other provinces constitutes one major cause for the widening disparities of provincial GDP per capita during the pre-reform period 1952-78, when considering all provinces in the sample.

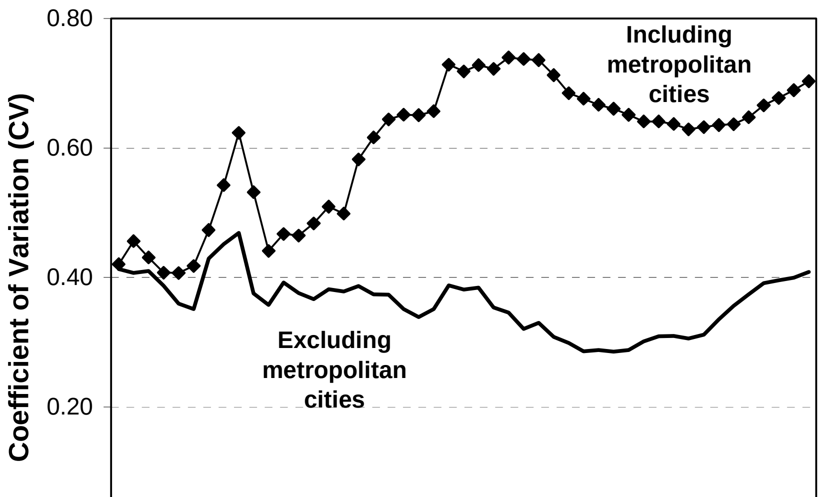

Figure 4: Coefficients of variation of China's provincial GDP per capita, including and excluding the three main metropolises.

The Gini coefficient trend in Figure 2 confirms the findings from the coefficient of variation. As mentioned above, Lorenz curves can also be used to visualize the trends. Figure 5 presents the difference between the Lorenz curve and the 45^{o} "perfect-equality" line in five selected years: 1952, 1966, 1978, 1990, and 1998. A lower line corresponds to lower disparity. The trend of increasing separation from the abscissa for the three curves of 1952, 1966 and 1978 reveals a widening disparity along these years.

The phenomenon that the curve of 1990 is lower than that of 1978, while the curve of 1998 moves up reflects the fact described above that the provincial disparity decreased from 1978 to 1990 and increased from 1990 to 1998.

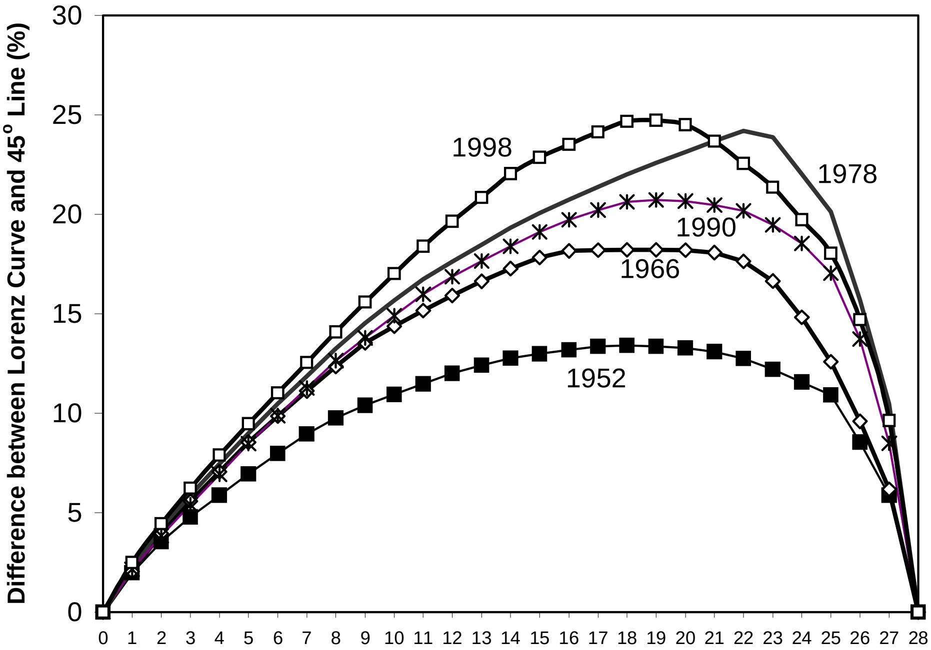

Figure 5: Difference between the Lorenz curve and the 45° perfect-equality line.

Figure 6 presents both the high-low ratio and the coastal-inland ratio of per capita GDP. The ratio of the most developed five provinces to the most underdeveloped five provinces has followed a very similar trajectory to that of the coefficient of variation for the 28-provinces sample. The development of the ratio of GDP per capita of coastal provinces to inland provinces grows steadily during the study period becoming somewhat steeper at the beginning of the 1990s.

Although real per capita GDP increased in almost every province, coastal provinces grew much faster. The steady faster growth of coastal provinces can, to some extent, explain the performance of the coefficient of variation. Since the fastest-growing coastal provinces started from a below-average level of per capita GDP in 1980s, this brought about a slight downward trend in the cross-section dispersion of per capita GDP. However, from the 1990's onward, as these provinces caught up and growth accelerated in the richest coastal provinces, the convergence process came to an end and the increasing disparity trend resumed.

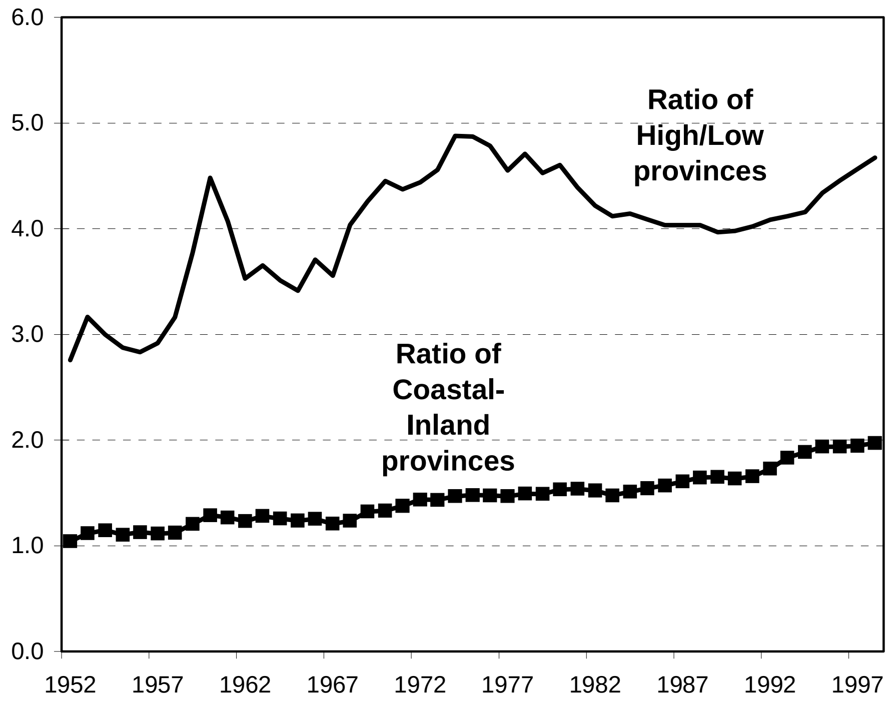

Figure 6: The ratio of high/low and coastal/inland provincial GDP per capita.

In order to examine in some more detail the difference between coastal and inland regions, Figure 7 plots the evolution of the coefficients of variation for these two groups of regions. For the coastal region, the indicator is computed both including (CVcoast1) and excluding (CVcoast1) the three metropolitan cities. Several basic observations can be derived from the graph. First, disparities within coastal regions are smaller than within inland regions. Second, in contrast to Wu's (1999) finding that the disparities within both the inland region and the coastal region excluding the three large cities have reduced considerably in the 1990s, this study does not achieve such a result. As shown in Figure 7, all three sets of regions, i.e., inland, coastal without metropolises, coastal with metropolises, show an increasing disparity trend in the 1990s. This coincides with several findings in the literature (e.g., World Bank, 1997; Lin *et al.*, 1998).

Third, the increasing CV within coastal regions (with or without the 3 big cities) implies that some coastal regions are growing much faster than others. Fourth, in contrast, relative variations of CV within inland regions appear smaller than in coastal regions, signaling the fact that these regions seem to be growing at similar rates, although absolute differences in GDP per capita within them may still be very large.

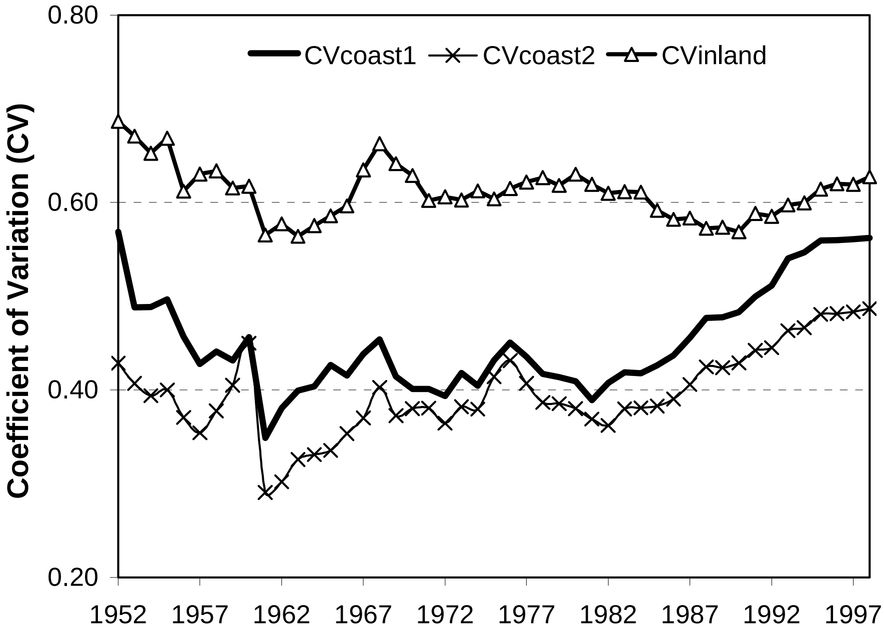

Figure 7: Coefficient of variation for coastal and inland regions. Notes: CVcoast1, CVcoast2 and CVinland are the estimated coefficients of variation for, respectively, the coastal region including Beijing, Tianjin and Shanghai, the coastal region excluding the three metropolises, and the inland region.

In summary, based on the above individual estimation and description, several observations are worthy of notice.

1) There is a continuous widening trend through the period 1952-1998 in terms of absolute dispersion of provincial GDP per capita (Figure 2).

2) The various indices for relative dispersion (i.e., CV, GC, RHL) move in close relation to each other (Figure 4 to Figure 6), and match the above-described different phases of Chinese development remarkably well. The relative disparity decreased in the early 1950s but increased dramatically in the late 1950s, partly due to the Great Leap Forward movement campaigned in 1958 and the Great Famine. Disparity fell again during the recovery from the Great Famine, but the effects of the Cultural Revolution, which began in late 1966, triggered an increase and disparity reached a peak again in 1978. The beginning of the rural reform period saw a decline in relative disparity, which extended to the late 1980s when China decentralized, opened up and experienced a substantial increase of trade and foreign direct investment. But disparity then rose steadily and sharply in the 1990s.

   In summary, over the second half of the 20th century, the dispersion of provincial GDP per capita in China has reached peaks during three periods: the Great Famine, immediately after the end of the Cultural Revolution and in the current period of market reforms.

3) The disparity within inland provinces is in general larger than that within the costal regions. However, disparity in the latter group exhibited a faster growing trend in the

post-reform period (see Figure 7). This means that the provinces within the inland region have similar paces of growth although they exhibit large differences in terms of absolute GDP per capita level, and that within the coastal region, some provinces achieved considerable more development than others.

4) The impact of the three large cities on the coefficient of variation is different when they are considered within the coastal region than when they are considered within the whole country's sample (as shown in Figure 4 and Figure 7). With the inclusion of these cities, the magnitude of 28-provinces CV nearly doubles, especially in the post-reform period. In contrast, the increase is not so dramatic within the coastal region.

4. Understanding the disparities

4.1 Convergence analysis: a test for unconditional convergence

We can examine the trends in provincial GDP disparities more formally by using the theory of economic convergence, since it is an appropriate tool to tackle the issue of regional disparity.

There are two concepts of convergence. Unconditional economic convergence focuses on the relationship between growth rates and initial levels of income across regions. The unconditional-convergence hypothesis implies that a poor economy should grow faster than a rich one, without any other factor than initial GDP affecting the growth rate of per capita GDP (Barro and Sala-i-Martin, 1995).

Conditional economic convergence refers to the hypothesis that an economy with a low initial income relative to its own long-run (or steady-state) potential level of income will grow faster than an economy that is already closer to its long-run potential level of income. In contrast to the unconditional convergence hypothesis, conditional convergence reveals how certain factors, other than the original level, influence the process of convergence. This can be used to analyze the causes for the variations in provincial GDP per capita disparity. This sub-section will test unconditional convergence, and the next section will perform more detailed regressions for an econometric model under the conditional convergence hypothesis.

Following Barro and Sala-i-Martin (1995), the following functional form is used to test the GDP per capita convergence among different provinces in China.

$$\frac{\ln(Y_{iT} / Y_{i0})}{T} = a - (\frac{1 - e^{-\beta T}}{T}) \cdot \ln(Y_{i0}) + \varepsilon_i \tag{4}$$

Where Y_{iT}, Y_{i0} correspond to GDP per capita of province i in the end year and initial year respectively. The coefficient a is a constant and ε_i is the random error. The coefficient on initial GDP per capita $(1 - e^{-\beta T})/T$ is an expression that declines with the decrease of β, for a given length (years) of the interval period T. the coefficient β

provides an estimate of the annual convergence or divergence rate A significant and positive β implies convergence across provinces. Conversely, a negative and significant value of β implies unconditional divergence.

We test for convergence in real per capita GDP levels across China provinces. We derived estimates of β for the second half-century period and various sub-periods corresponding to changes in the economic policy. The time span is first divided into two periods, pre-reform (1952-78) and post-reform (1979-98). Then, both the pre-reform and post-reform periods are further subdivided into two periods each, for a more detailed investigation. For the pre-reform period, the two sub-stages from 1952-66 and 1967-78 are considered. For the post-reform period, two sub-stages 1979-89 and 1990-98 are defined. The summary of the results is presented in Table 2. We present results for two cases. In the first case, no additional dummy variables are included in the regression. In the second case a coastal dummy variable is added to the regression, following Barro and Sala-i-Martin (1995) recommendation that inclusion of regional dummies could help to obtain more accurate estimates.

Table 2: Estimation results of unconditional convergence.

Periods	Without regional dummy		With regional dummy	
	β	F-test	β	F-test
1952-1998 [a]	0.003 (-0.49)	0.24	0.004 (-0.83)	*8.46
1952-1978 [a]	0.006 (-0.69)	0.47	0.006 (-0.71)	0.44
1952-1966 [a]	0.005 (-0.38)	0.15	0.004 (-0.29)	0.23
1967-1978 [a]	-0.009 (0.98)	0.96	-0.009 (0.95)	1.86
1979-1998 [b]	0.007 (-0.86)	0.75	0.013 (**-1.84)	*10.11
1979-1989 [b]	0.012 (**-1.94)	**3.76	0.015 (*-2.76)	**6.90
1990-1998 [b]	-0.011 (1.28)	1.65	-0.001 (0.17)	*8.86

Notes: the number in brackets is the t-ratio for the corresponding estimation of the β coefficient.

* Significant at the statistical level of 1%, ** Significant at the statistical level of 10%

[a] Data for 28 provinces are included, excluding Hainan and Tibet due to missing data, and consolidating Chongqing data with those of Sichuan

[b] Data for 30 provinces are included, consolidating Chongqing data with that of Sichuan.

We first take a look at the results of the estimation for the whole period under consideration (1952-1998). The estimated β is low and insignificant in both cases (i.e., with and without dummy coastal variables). In the regressions without the coastal dummy, the estimated value for β is 0.003 with a very low *t*-ratio indicating insignificance. Even if this estimate were significant, it would suggest an extremely slow speed of convergence (0.3 percent per year), as compared, for instance, with the average convergence rate of 2 percent per year in US state income reported in the literature (Barro and Sala-i-Martin, 1995)[7]. Adding the coastal dummy increases the estimate for β by 0.001, but it still remains insignificant.

[7] Barro and Sala-i-Martin (1995) studied the income behavior of states in the United States from 1880 to 1990. They estimated β each decade obtaining an average estimate of 0.02.

A model specification test (F-test), presented in the third column of Table 2, shows that almost all regression models, except the one for 1979-89, are not valid at 10 percent of statistical significance level if they do not include the coastal dummy variable. This can be interpreted as a hint that there are no simple linear relations between the average growth rate and the level of the initial GDP per capita among the 28 provinces during the periods under examination, except for the period 1978-89. In other words, there is no evidence for trends of either unconditional convergence or unconditional divergence during those periods.

When a coastal dummy variable is added, the specification of the models improves and another three models for 1952-98, 1978-98 and 1990-98 become statistically significant. However, the significance of the estimate of the β parameter is only improved in the model for 1978-98, where it becomes significant at 10% of statistical confidence. Some improvement is also seen in the estimate of β in the model specified for the period 1978-89, where β was already significant in the case without the coastal dummy variable.

From the summary statistics given in Table 2, we arrive at the following findings about unconditional convergence:

1) During the period from 1952 to 1998 as a whole, there is no evidence either of unconditional convergence or of divergence. This means that the relative changes in regional disparity among the 28 provinces are not significant.
2) The estimates for the pre-reform period (1952-78) and its two sub-periods, 1952-66 and 1967-78, also fail to provide evidence for convergence. Thus, the same conclusion as above is reached, i.e., that during the periods under consideration here there are no statistically significant relative changes in regional disparity across provinces.
3) If the coastal dummy is included, it could be concluded that the post-reform period (1978–98) as a whole witnesses an unconditional convergence (a positive and significant convergence rate β of 0.013 is obtained). However, if the coastal dummy is omitted, we could not draw such conclusion The fact that the estimate does change after introducing the coastal dummy to control for the coastal-inland region differences suggests that the speed of convergence is not the same in the coastal and inland areas. However, this result also illustrates the sensitivity of this kind of analyses of economic growth to the choice of variables (see e.g., Young, 1995 for a discussion).
4) During the first sub-period (1979-89) of the post-reform phase, there is more evidence of unconditional convergence. First, this is the only sub-period that shows a significant F-test and t-ratio for the coefficient of β without the coastal dummy. Second, the t-ratio increased to be significant at the 1% statistic level when adding coastal dummy. Third, the value of the convergence coefficient β that indicates the speed of the convergence is larger (0.015) and relatively close to the U.S. average state convergence rate of 0.02. All of the above are evidences of an unconditional convergence among the 28 provinces.
5) During the second sub-period (1990-98) of post-reform, the trend of unconditional convergence ceased. Although the sign of the coefficient β is negative, its t-ratio

does not show statistical significance. Thus, the regression for this sub-period does not support the claim that there was an unconditional divergence among the provinces during this period. Figure 8 gives further evidence against convergence or divergence for this period. The figure presents a scatter plot of average annual per capita GDP growth as a function of the logarithm of per capita GDP in the initial year of 1978. Unconditional convergence would occur if poorer provinces tend to grow more quickly. Therefore, we would expect a downward relationship in this figure, or an inverse trend for divergence. However, none is apparent.

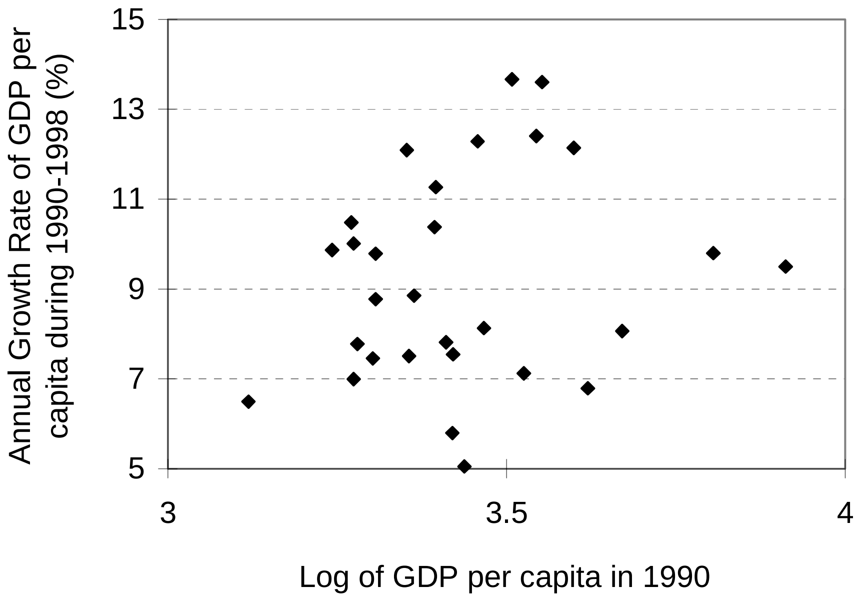

Figure 8: Illustration of unconditional convergence for the period 1990–1998.

4.2 Econometric model test using the conditional convergence framework

4.2.1 Basic framework and variable descriptions

A growth equation is estimated here based on an extended version of the neoclassical growth model as described by Barro (1991) and Radelet *et al.* (1997). This model allows testing for conditional convergence by adding a set of variables determining the steady state to an unconditional convergence equation. This approach does not identify all of the specific factors associated with GDP per capita performance across provinces. Rather, it is an attempt to distill the large number of information available on all the provinces into a more compact framework that allows identifying a small set of variables that stand out as the most important factors influencing disparity.

The variables chosen for the analysis depend on economic theory considerations, a priori beliefs of the analyst, previous experiences reported in the literature and data availability (Trivedi, 2002). In order to account for cross-province differences in GDP per capita growth rates, we try to consider a variety of factors that have been proposed by earlier studies as important determinants of long-run GDP growth. These explanatory variables can be grouped into following four dimensions.[8]

(1) Initial conditions (initial per capita GDP, initial agriculture share of GDP)

(2) Geography (coastal dummy/coastline density, transport endowment)

(3) Economic policy (openness index)

(4) Capital (production factors) accumulation, especially physical and human capital (fixed-asset investment ratio, human capital-investment ratio).

A summary of the nationally averaged variables, grouped by two sub-periods, is presented in Table 3.

Table 3: Summary of variables by sub-period (non-weighted averages).

Variables	1952-78	1979-98
Initial conditions		
Initial per capita GDP (RMB, in 1998 price)	485	1449
Initial agriculture share of GDP (%)	57	33
Geography		
Coastal dummy	0.37	0.37
Coastline density	0.68	0.68
Transport endowment (km/km^2)	9.15	13.09
Economic policy		
Openness index	0.00	0.96
Capital accumulation		
Fixed-asset investment / GDP (%)	13	29
High educated pop. / Population (%)	0.78	2.58

Sources: SSB (1999)

Initial conditions: In the basic framework, for given values of the other explanatory variables, the model postulates that a province with a lower initial per capita GDP is in a more favorable position for future growth.

The basic idea for introducing the initial size of the agricultural sector is that the heavy-industry development strategy in the pre-reform period may have caused agricultural provinces to have fewer opportunities for productivity growth than industrial provinces. Thus, they may have grown substantially more slowly. On the other hand, the reform period started with the large-scale deregulation of agriculture, thus this should have benefited the agriculture provinces.

[8] Notice that we performed regressions with some demographic variables (both total population growth rate and working-age population growth rate) but the results were unclear, i.e., a negative coefficient of working-age population growth rate was obtained while the coefficient for total population growth rate was positive. In other studies reported in the literature, demographic variables have yielded mixed influences to the growth (e.g., Bloom and Williamson, 1998). Thus the reported regressions do not include a demographic variable. However, we do acknowledge the importance of the contribution of this variable to economic growth (see e.g. Kelley and Schmidt, 2000) and its influence should be addressed in future work.

Geography: The most commonly highlighted feature in the extensive studies on China's regional disparity is the growing gap between the coastal provinces and the inland provinces. By introducing a coastal dummy into the growth model, this study assumes that the provinces within each group (coastal or inland) share the same steady state given other variables.

However, the coastal dummy can usually be interpreted as a combination of independent causes and some important determinants of economic growth. Especially, for China's conditions, it is an amalgam of "pure geography effects" and "preferential-policy effects" (Démurger *et al.*, 2001), as many preferential policies benefit mainly the coastal region.

Therefore, since we are considering the openness policy variable independently, as described in the next paragraph, two other indicators, coastline density and transport endowment, will be used here to replace the coastal dummy in purely measuring the "geography effects". That is, these two variables will measure the differences in the costs of transportation for trading with other economies, both at the domestic and international levels. Coastline density is the ratio of a provincial coastline distance to its land area, which gives a rough measure of the share of the population with relatively easy access to the sea. Transport endowment is the density of railways, roads and inland navigable waterway networks.[9]

Openness policy index: Economies open to the outside will have greater access to new technologies, larger markets, and improved management techniques. They also tend to have fewer distortions and better resource allocation and their firms are more likely to be competitive in world markets. Several indicators can measure the openness, such as foreign direct investment, international trade and tariffs. We use the openness index constructed by Démurger *et al*. (2001). The construction of the openness policy index is based on the number of designated open economic zones in a province and the extent of the preferential treatment.[10] Table A2 in the appendix reports the results of this scaling.

Capital accumulation: We examine two kinds of variables that may represent the contribution of capital to economic growth. The first variable measures physical capital accumulation, and is calculated as the ratio of fixed-assets investment to total GDP.

The second variable chosen in this study is a proxy for the ratio of human capital investment to GDP. Recent economic growth literature has emphasized the importance of education and human capital in the process of economic growth and development (see e.g., Yang and Yao, 2001; Kelley and Schmidt, 2000). Here, referring to the work

[9] These factors have been taken into account together, since it is difficult to distinguish benefits from one transportation mode to another. The quality differences among provinces are also omitted because of data limitations.

[10] The construction of this index relies on available information on designated open economic zones across China, gathered from different sources, as well as a subjective classification based on their importance in terms of special treatment given to investors and industrial enterprises. Given the various degrees of preferential policies that open economic zones offer, the following weights distribution is adopted (Démurger *et al.*, 2001):
Weight = 3: Special Economic Zone and Shanghai Pudong New Area;
Weight = 2: Economic and Technological Development Zones, and Border Economic Cooperation Zones;
Weight = 1: Coastal Open Cities, Coastal Open Economic Zones, Open Coastal Belt, Major Cities along the Yangtze River, Bonded Areas, and Capital Cities of inland provinces and autonomous regions;
Weight = 0: No open zone

reported by Persson (2002) on the contribution of human capital to economic growth, the average percentage of population enrolled in regular institutions of higher education over the sample period is used [11].

4.2.2 Regression results

Using different combinations of variables, four different regression equations have been considered in order to explain the provincial GDP per capita growth rate in the two sub-periods of pre-reform era and post-reform era. The four equations are referred to as Reg. 1 to Reg 4 and the corresponding results are presented in Table 4.

Reg.1 explores only two determinants, namely the logarithm of the initial per capita GDP and the coastal dummy, which has been discussed in the analysis of unconditional convergence above.

Reg.2 performs a decomposition of the coastal dummy's mixed effects of geography and policy, by replacing the coastal dummy with the openness index as a proxy for the degree of openness, and the coastline density and transport endowment as the proxies for provincial accessibility to other economies. When using this model specification, and in contrast to the findings in Reg.1, evidence is found that both sub-periods have seen conditional convergence, according to the negative and significant coefficients of the logarithms of initial GDP per capita. The openness index and the transport density show positive and significant coefficients, while the coastline density appears to have no significant effect. The coastline density variable is statistically insignificant because the openness index already reflects the regional effect to some extent and, therefore, the coefficient of correlation between the openness index and the coastline density is high (0.82).

Reg.3 estimates relatively complete specifications of provincial growth equations by introducing initial agriculture share of GDP, education level index and fixed-asset investment ratio.

For the pre-reform sub-period, all of the three added variables have the theoretically expected sign and receive strong statistical support. The negative coefficient for the initial agriculture ratio corroborates China's heavy-industry-biased development strategy during the pre-reform era. Comparing with Reg.2, the transport density turns out to be insignificant. One possible explanation can be that there is correlation between transport density and fixed-asset investment.[12] The coastline density remains insignificant in Reg.3.

For the post-reform sub period, both the openness index and education level correctly appear to have a positive and significant effect on growth differences. The positive

[11] As pointed out by Li *et al.* (1998), such measure of investment in human capital is imperfect. The variable ignores primary education and occupational training, and it does not reflect educational quality variations across provinces. Moreover, there are other attributes of human capital that need to be measured, such as health status. But given the data available, this was the best measure that could be constructed for this study.

[12] The correlation coefficients between these two variables are 0.25 and 0.53 for, respectively, pre-reform and post-reform periods.

coefficient for the agriculture variable confirms that the large-scale deregulation in agriculture at the beginning of the reform era led agricultural provinces to grow at relatively high rate. In the same way as with the result of the pre-reform period, both coastline density and transport density are statistically insignificant. As for the investment variable, its inclusion cannot confirm the contribution of fixed assets to growth differences, although theoretically this should be the case. There is an unexpected sign for investment rate, and the t-test shows statistical insignificance.

Table 4: Cross-section regressions for unconditional convergence.

Variables		log (GDP_0)	Coast dummy	Coastline Density	Transp. density	Open. index	Ini. Agri. Ratio	Edu. Level	Inv. rate	Inv.-Coast. Interaction	A-R^2	F-test
Reg. 1	1952-78	-0.86	-0.05								0.08	0.38
		-0.31	0.05									
	1979-98	-2.78	2.47								0.32	***10.1
		*2.03	***3.73									
Reg. 2	1952-78	-6.58		-0.14	0.21						0.62	***15.9
		***3.56		0.50	***6.73							
	1979-98	-6.34		0.22	0.06	1.75					0.49	***10.3
		***3.76		0.65	**2.32	***3.07						
Reg. 3	1952-78	-5.31		0.31	0.05		-0.04	4.77	0.09		0.86	***27.6
		***4.05		1.55	1.28		*1.95	***3.51	***3.77			
	1979-98	-5.3		0.16	0.004	1.75	0.04	4.57	-0.04		0.70	***7.3
		**2.20		0.43	0.08	***3.01	1.24	*1.70	0.71			
Reg. 4	1952-78	-5.33					-0.07	5.24	0.08	0.04	0.84	***28.8
		***3.85					***3.87	***3.88	***3.33	0.95		
	1979-98	-5.54				1.28	0.07	5.83	-0.02	0.06	0.67	***11.6
		***3.37				***3.03	**2.25	***4.03	0.47	**2.24		

***Notes*:** The dependent variable is the average growth rate of per capita GDP for each province in the indicated period. The constant term is not reported. The number in italics corresponds to the absolute t-statistic rate.

1) The sample for 1952-78 excludes Hainan, Tibet and Chongqing. The sample for 1979-98 excludes Chongqing.

*** Significant at the statistic level of 1%, ** significant at the statistic level of 5%, * significant at the statistic level of 10%.

An additional regression equation (Reg.4) is tried to investigate whether the impact of investment on GDP growth varies by region. For this purpose, an investment rate - coastal dummy interaction is added to the regression and, correspondently, the coastline density is removed from it. At the same time, the transport endowment variable is also removed[13]. The interaction variable is the product of the investment rate and the coastal dummy. A positive coefficient on this variable would mean that investment has a greater positive impact on GDP growth in the coastal provinces than it does on the nationwide average, which would imply its larger influence on GDP growth in the coastal regions than in inland regions.

As it is shown in Table 4, during the pre-reform period the investment rate remains significant and with a larger coefficient than that of the interaction variable, which is statistically insignificant. This indicates that investment is a significant influential factor

[13] An additional test was performed including transport density in Reg.4. No significant differences between the results with and without transport density were found, and the transport variable showed no statistical significance.

in the provincial GDP growth differences. In addition, no systematic difference is found between the effect of investment rate on GDP growth within inland provinces and that within coastal provinces.

On the contrary, the result for the post-reform period shows a negative but insignificant coefficient on investment rate. However, the coefficient of the interaction variable is positive and significant, with a larger absolute value than that of investment rate coefficient. This suggests that the higher investment rate in the coastal provinces has contributed to more rapid growth while within the inland provinces such trend does not appear.

Besides producing theoretically reasonable coefficients for both the investment rate and the interaction term, Reg.4 appears to give good regression results for all other variables for the two sub-periods in question. The R^2 coefficient and the F-test also indicate that this equation specification is statistically acceptable.

Based on the above description of the regression results, several common findings can be arrived at. First, the results show evidence for conditional convergence. The initial GDP level has a negative sign and strong statistical support in all of the four specifications applied to the post-reform phase, and in three out of four cases for the pre-reform phase.[14]

Second, the regression results point out the significant role of the openness policy variable in explaining the differences in provincial GDP growth. When included in the regressions the openness index appears strongly and positively associated with GDP growth.

Third, contrary to other studies that have found only a weak direct link between education and growth, the estimated coefficient on the human capital investment variable (in terms of higher educated population ratio) is positive and strongly significant in the regression both for the pre-reform and post-reform eras. This result gives evidence of the significant impact that human capital investment has on GDP growth differences in China and points out the need to emphasize this aspect if China is to sustain its growth in the future.

Fourth, the investment rate has a positive and significant impact on GDP growth variations. This result becomes particularly significant after taking into account the coastal-inland differences.

Fifth, the provinces with higher agriculture share of GDP grew slower during the pre-reform era and faster during the post-reform era than the provinces with lower agriculture share, after controlling for other determining variables.

[14] Moreover, this result holds even when municipalities (i.e., Beijing, Tianjin, and Shanghai) are excluded from the sample.

4.2.3 A robustness test for variations in sample size and specification

In order to test the robustness of the results from Reg.4, two sub-samples of China's provinces were used to re-estimate the equation. First, the three metropolitan provinces (Beijing, Tianjin and Shanghai) were removed from the sample in order to check whether these big cities had been influencing the overall results. The estimation results were broadly similar to those from the full sample, as shown in Table 5. Second, five (5) provinces in the sample are randomly removed out. Once again, the results (shown in Table 5) were broadly similar to the original results.

Table 5: Cross-section regressions for unconditional convergence, smaller sample size.

Variables		log (GDP_0)	Open. index	Ini. Agri. Ratio	Edu. Level	Inv. rate	Inv.-Coast. Interaction	A-R^2	F-test
Reg. 4	1952-78	-5.33		-0.07	5.24	0.08	0.04	0.84	***28.8
Original		***3.85		***3.87	***3.88	***3.33	0.95		
sampled	1979-98	-5.54	1.28	0.07	5.83	-0.02	0.06	0.67	***11.6
		***3.37	***3.03	**2.25	***4.03	0.47	**2.24		
Three big	1952-78	-4.98		-0.04	7.23	0.09	0.10	0.64	***9.63
cities out of		***4.03		*1.68	1.10	***3.58	**2.41		
sample	1979-98	-6.68	1.01	0.08	12.3	0.003	0.08	0.74	***13.1
		***2.89	*2.15	**2.71	***3.14	0.08	**2.48		
Five provinces	1952-78	-6.46		-0.08	4.70	0.07	0.02	0.85	***26.8
randomly		***4.21		***4.12	***3.34	*2.10	0.44		
dropped out	1979-98	-5.04	1.27	0.08	5.73	-0.007	0.06	0.64	***7.9
		**2.11	**2.76	**2.24	***3.50	0.14	*1.86		

Notes: see notes of Table 4.

5. Conclusions and future research

Understanding the causes and implications of the widening income disparity across provinces in China is important for the definition of policy measures that could effectively address this problem in the long term.

The first major finding in this study is that provincial disparity has experienced considerable fluctuation in the period of 1952-98, having reached peaks in three main periods. The first decade (1980s) of post-reform era significantly contributed to the reduction in regional disparities, but this trend ceased from the beginning of 1990s, when disparities began again to widen substantially.

The second major finding is that there is no evidence either of unconditional convergence or of divergence during the sub period of pre-reform (1952-78) and the entire period from 1952 to 1998, while there is some evidence of unconditional convergence for the first decade of the post-reform era. The conditional convergence for both pre-reform and post-reform periods respectively, however, have strong statistical support from the econometric regressions conducted here.

In spite of only six explanatory variables used, the conditional convergence growth model appears to provide a good regression of cross-province data over both the sub-period 1952-78 and the sub-period 1979-98. As predicted by the model, GDP per capita growth rates were higher in provinces with lower initial income level, more investment in physical and human capital and greater openness to foreign countries. The initial agricultural share of GDP exhibited significant but reverse contribution to the growth rates for the two sub-periods. That is, provinces with higher agriculture share grew slower in pre-reform era, but they grew faster in the post-reform era.

The result of conditional convergence does not contradict the fact of widening disparity between provincial GDP per capita levels after 1990. The conditional convergence means that the per capita GDP differences among provinces narrowed if the steady state of individual provinces is estimated. This implies that the widening dispersion was due to the increasing variation in the steady states of provincial economies.

The caveat must be stated here that the results reported in this study strongly depend on the variables chosen for the regression analysis. As discussed by Young (1995), this kind of analyses of economic growth is very sensitive to the choice of variables and, therefore, the conclusions derived from these studies should be taken carefully.

Moreover, these findings may change as more advanced methods, better underlying data, and more appropriate or different indicators are employed for the analysis. Some suggestions for possible refinements are given here as follows:

First, the data quality could be explored more carefully. The reliability of official Chinese data has received some criticism in the literature. Comparing the official data with other estimates by some international organizations (e.g., World Bank, OECD, etc.), testing the consistency of some critical parameters (e.g., provincial price deflators used to derive GDP in constant price, etc.) could help to increase the credibility of the findings.

Second, in the economic growth literature, population dynamics has been identified as an influential variable in the determination of economic growth. Since the demographic transition - a change from high to low rates of mortality and fertility - has been dramatic in China during the second half of 20th century, a closer look at the complex relationship between demography and China's provincial economic growth differences is strongly suggested.

Third, more work needs to be done to find out more accurate indicators for various factors such as openness policy, human capital investment, geography, etc. In addition, more attention should be given to the examination of the rural-urban income gap, which is likely to remain strong in the near term future and could pose a difficult dilemma to Chinese policy-makers (for a discussion, see Chang, 2002). Finally, using a more detailed regional division (e.g., classifying the provinces into coastal, central, and western regions) may help in obtaining more concrete implications for regional development policy.

As China joined the World Trade Organization (WTO) and continues its market-oriented reforms, the economy will become more liberalized and open. This is likely to result in more dramatic shifts in provincial steady states. If the government continues to favor the coastal provinces, that is, assigning more preferential policies and more investment in coastal than in inland provinces, regional disparity may widen even more.

The Western China Development Strategy and other policies aiming at increasing investment and stimulate openness in the inland provinces is thus important for China to both promote economic growth, reduce regional inequality and ensure political and social stability. According to this study, among other factors, sustained investment on human capital should attract special attention when implementing such regional development policies.

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Appendix

Table A1: Time evolutions of 5 indicators for GDP per capita disparity.

Year	SD	CV	GC	RHL	RCI	Year	SD	CV	GC	RHL	RCI
1952	204	0.42	0.196	2.76	1.04	1976	855	0.73	0.318	4.79	1.48
1953	251	0.46	0.224	3.16	1.12	1977	908	0.72	0.309	4.55	1.47
1954	249	0.43	0.219	3.00	1.15	1978	1014	0.74	0.312	4.71	1.49
1955	246	0.41	0.206	2.88	1.10	1979	1068	0.74	0.306	4.53	1.49
1956	275	0.41	0.212	2.83	1.13	1980	1148	0.74	0.310	4.60	1.53
1957	295	0.42	0.215	2.92	1.12	1981	1163	0.71	0.301	4.39	1.54
1958	396	0.47	0.239	3.16	1.12	1982	1206	0.68	0.294	4.22	1.52
1959	512	0.54	0.275	3.77	1.21	1983	1295	0.68	0.285	4.12	1.48
1960	599	0.62	0.307	4.48	1.29	1984	1457	0.67	0.287	4.15	1.51
1961	342	0.53	0.266	4.07	1.27	1985	1607	0.66	0.286	4.09	1.54
1962	257	0.44	0.235	3.53	1.23	1986	1675	0.65	0.284	4.03	1.57
1963	293	0.47	0.249	3.66	1.28	1987	1787	0.64	0.285	4.04	1.61
1964	325	0.46	0.244	3.51	1.26	1988	1949	0.64	0.287	4.04	1.65
1965	375	0.48	0.241	3.41	1.24	1989	1982	0.64	0.286	3.97	1.65
1966	431	0.51	0.256	3.71	1.26	1990	2034	0.63	0.284	3.98	1.64
1967	386	0.50	0.245	3.56	1.21	1991	2188	0.63	0.287	4.02	1.66
1968	430	0.58	0.270	4.04	1.24	1992	2500	0.64	0.293	4.09	1.73
1969	515	0.62	0.282	4.26	1.32	1993	2861	0.64	0.297	4.12	1.83
1970	628	0.64	0.296	4.45	1.33	1994	3280	0.65	0.303	4.16	1.89
1971	675	0.65	0.295	4.37	1.38	1995	3753	0.67	0.311	4.34	1.94
1972	687	0.65	0.293	4.44	1.44	1996	4162	0.68	0.315	4.46	1.94
1973	720	0.66	0.295	4.56	1.44	1997	4660	0.69	0.320	4.56	1.95
1974	815	0.73	0.320	4.88	1.47	1998	5181	0.70	0.326	4.67	1.97
1975	855	0.72	0.318	4.87	1.48						

Notes: GDP per capita figures are converted into 1998 prices. The Hainan province and Tibet autonomous region are excluded due to incomplete data and Chongqing's data is consolidated with Sichuan province. Thus, the real sample size is 28 provinces. SD: standard deviation of provincial GDP per capita; CV: coefficient of variation; GC: Gini coefficient; RHL: ratio of high/low provincial GDP per capita; RCI: ratio of coastal/inland provincial GDP per capita.
Source: calculated by the authors based on the data from SSB (1999)

Table A2: Openness policy indicator.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
Beijing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0.67
Tianjin	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1.43
Hebei	0	0	0	0	0	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1.24
Shanxi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Inner Mongolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0.67
Liaoning	0	0	0	0	0	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1.24
Jilin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0.67
Heilongjiang	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0.67
Shanghai	0	0	0	0	0	0	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	1.76
Jiangsu	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1.43
Zhejiang	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1.43
Anhui	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2	2	0.62
Fujian	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.71
Jiangxi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Shandong	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1.43
Henan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Hubei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2	2	0.62
Hunan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Guangdong	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.86
Guangxi	0	0	0	0	0	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1.24
Hainan	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	1.57
Sichuan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	2	2	2	0.62
Guizhou	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Yunnan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0.67
Tibet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Shaanxi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Gansu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Qinghai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Ningxia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0.33
Xinjiang	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	0.67

Notes: see footnote 10

Source: Démurger *et al.* (2001)